

**Five Year Integrated M. Sc. Examination 2022**

**Semester-V**

**Paper: MT-3-5-5**

**Subject: Mathematical Theory of Probability & Statistics**

**Time: Three Hours**

**Full Marks: 40**

Questions are of value as indicated in the margin

(Answer *any four* questions)

1. (a) Suppose you have a bag of beans of which 20% are black and remainder are white. Determine the probability that a single sample of eight beans drawn from the bag will contain at least six white beans.  
(b) There are two drawers in each of the three boxes that are identical in appearance. The first one contains a gold coin in each drawer, the second one contains a silver coin in each drawer, but the third contains a gold coin in one drawer and a silver coin in the other. A box is chosen at random, one of its drawers is opened and a gold coin is found. What is the probability that the other drawer too will have a gold coin? 4+6
2. (a) Find the mean and variance of a Binomial distribution with parameter  $n$  and  $p$ .  
(b) With 10 tosses what is the chance of getting 5 heads assuming the coin to be an unbiased one? How will you modify your calculation if the probability of getting a head in a single toss is 0.3? 6+4
3. (a) Show that mean deviation about mean is zero.  
(b) Let  $\rho_{xy}$  be the correlation between  $x$  and  $y$ . Let  $u = a + bx$  and  $v = c + dy$ . Find correlation coefficient between  $u$  and  $v$  in terms of  $\rho_{xy}$ . 3+7
4. Define unbiased estimator. Is it unique? Show that sample mean is the BLUE for the population mean. 2+2+6
5. Let  $X \sim N(\mu, \sigma^2)$ . Find the expressions for  $\mu'_1$ ,  $\mu_2$  and  $\mu_3$ . Using these moments find a measurement of skewness for the distribution and comment. 8+2